METHOD AND APPARATUS FOR INTERFACING A PLURALITY OF DEVICES TO A COMPUTER NETWORK

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a division of Application Serial Number 09/506,925 filed February 18, 2000 which is a division of Application Serial Number 09/184,972 filed November 3, 1998, now U.S. Patent No. 6,028,679, which was a division of Application Serial Number 08/555,911 filed November 13, 1995.

BACKGROUND OF THE INVENTION

The present invention is directed to a method and apparatus for securely transforming and transmitting electronic information from one protocol form to another protocol form for delivery over a packet-switched network. The invention has particular application where the information pertains to the visual perception of images, and where the information must be delivered securely in an environment where its receipt and authenticity can not be disputed or repudiated.

The sending of visually perceptible images is well known in the prior art, the earliest examples being those of the inventions of the facsimile machine.

In recent years the facsimile machine has become a common device in businesses both large and small and also in many homes. In 1966 the so called Group or Class 1 standards where adopted and with that came the start of the present popularity of the device. Although it took about six minutes to transmit a single page and the resolution was poor it was a big improvement over mail especially for international communications. In 1978 Class 2 standards appeared followed in 1980 by the Class 3, which machines were much faster and had much better resolution. These latter machines take a bout 30 seconds to transmit a page of text.

Ubiquitous physical stand alone fax machines remain the norm today for every day transmission of written documents and images but lack the ability to directly connect to and send/receive such documents across Internet global area packet switched networks. The term "internet global area packet switched networks" is used herein in the generic sense of interconnected regional, national and international networks over which information in electronic form is transmitted. The "Internet" currently is perhaps the best known of these networks.

While fax machines are now thought of as universal all class 1, 2, and 3 machines are currently direct telephonic connection devices and as such acquire toll charges for their use over the telephone companies switches. This of course means that the sender must pay intrastate and interstate long distance toll charges for

the time it takes to transmit the desired communication, which in a busy office can amount to hundreds of dollars a month and in an international company to many thousands of dollars. Todays common fax machines cannot communicate directly over internet global area packet switched networks nor can they send and receive electronic mail or web page formats Security of internet global area networks communications also is currently difficult to achieve and ensure. The ability to definitively verify the identity of the sender of a fax transmission is often difficult if not impossible to achieve. Also if absolute security is required expensive encryption/decryption devices must be employed to communicate by fax over public telephone lines. Secure private lines can be used but are expensive and limited in the addresses that can be accessed.

The ability to choose when to receive fax transmissions and to decide which ones to print and which ones to discard is not readily available to the average fax user. Negotiating fax transmissions, particularly on a multi use single telephone line, often requires ancillary communications to achieve; i.e. telephone call to agree on when to "turn on the fax machine", priority, re-transmission on "busy", undeliverable, etc.

Figure 10 is a block diagram of a conventional facsimile machine as known in the art. The machine includes a transmit section and a receive section. The transmit section is used for

transmitting image data from a scanned document to a remote facsimile machine and the receive section is used for receiving image data from a remote machine for printing at an internal print station.

In state of the art facsimile machines, the transmitter section 500 (see Figure 10) typically includes a scanner device 501 which scans the page to be transmitted in accordance with a predetermined format. Scanner device 501 is often formed of one or more charge coupled devices (CCD) and produces an electrical signal which correspond to the image on the page. The scanning process is achieved by dividing the page into uniform lines of uniform pixel elements.

In a black and white facsimile transmission, each pixel represents a black or white dot on the page. The more pixels, per line and the closer the lines are together, the higher the resolution of the facsimile image which can be transmitted. In Group 3 facsimile machines, for example, each line contains 1728 pixels. A typical page contains about 2200 scan lines. The actual number of scan lines will depend, of course, on the length of the page. The page is read by the scanning device moving line-by-line down the page and providing a corresponding digital electrical signal for the picture information native facsimile image data at each of the pixel locations. In standard Group 3 Facsimile

equipment the picture information is 1 dimensionally compressed useing a modified Huffman run length coding scheme.

With reference again to Figure 10, the digital signal from scanning device 501 is supplied to digital-to-analogue (D/A) converter or modem 502. The D/A converter 502 converts the digital signal to a corresponding analogue signal in the form of audio 450 Hz to 4950 Hz frequency tones. The audio tones are then transmitted over telephone line 503 to the remote facsimile machine. The remote facsimile machine contains a receiver section 510. Receiver section 510 receives the audio frequency tones from telephone line 503. The tones are converted in to corresponding digital signals by analogue-to-digital (A/D) converter or modem 511. The digital output from A/D converter 511 is supplied to a print station 512 where the facsimile image is printed for the user to see.

In cases where security and privacy is required, the facsimile transmission can be encrypted or scrambled. Encryption techniques typically are used to secure digital signals while scrambling techniques are used to secure analogue signals.

The advent of the computer age brought with it the need in many instances to provide some mechanism for protecting the privacy of information transferred electronically. The problem was identified as early as the mid 1960s and one of the first cipher codes to protect data emerged in 1971. The U.S. National Security Agency (NSA), as well as others, recognized the need for a more

secure code which could withstand sophisticated crypto analytical attacks. In response to this need, the Data Encryption Standard (DES) was developed and became the official civilian cipher of the U.S. government in June of 1977.

The DES specifies an algorithm to be implemented in electronic hardware for the purpose of cryptographic protection of computer data. The computer data may be cryptograhphically protected using the DES algorithm in conjunction with a key. The key is generated in such a way that each of the 56 bits used directly by the algorithm are random and the 8 error-detection bits are set to make the parity of each 8-bit byte of the key odd, i.e., there is an odd number of "1s" in each 8-bit byte. Each member of a group of authorized users of encrypted computer data must have the key that was used to encipher data in order to use the data. This key, held by each member in common, is used to decipher any data received in cipher form from other members of the group. The encryption specified in the DES standard is commonly know among those using the standard. The unique key chosen for use in a particular application makes the results of encrypting data, using the algorithm, unique. Selection of a different key causes the cipher, which is produced for any given set of inputs, to be different. The cryptographic security of the data depends on the security and key length provided for the key that is used to encipher and decipher the data.

Data can be recovered from a cipher only by using the exact same key that was used to encipher it. Unauthorized recipients of the cipher, who know the algorithm but do not have the correct key, cannot easily derive the original data algorithmically. The more secure the keys algorithm and the longer its bit length the more difficult it becomes to "crack" the keys coding scheme. Use of "one time pad" keys further deters unauthorized decryption of key encoded messages. On the other hand, anyone who does have the key and the algorithm can easily decipher the cipher and obtain the original data. A standard algorithm, which is based on a public/private key, thus provides a basis for exchanging encrypted data and the known system, which is often identified in the art as a Public Key Infrastructure, becomes a standard means of secure data.

While various encryption techniques can be used to secure digital signals, analogue signals are made secure by scrambling the signal waveform. Scrambling approaches include inverting the wave form, shifting the bias level of the signal, changing the time base for a portion of the signal and reordering portions of the signal, all in accordance with a predetermined scrambling format and scrambling key. Descrambling is achieved by reversing the scrambling process at the receiver end in accordance with the scrambling key.

With reference again to Figure 10, the transmitted facsimile image data may be encrypted by encryption device 504 as explained above while it is still in digital form. Alternatively, the image data may be scrambled by scrambling device 505 after conversion to analogue form by D/A converter 502. At the receiver end, the process is reversed by descryption device 513 or descrambling device 514 in accordance with the appropriate key.

In recognition of the growing demand for security and privacy with respect to transmission of e-mail and secure web based messages over the Internet, a number of secure e-mail and web based standards have been developed. One proposed such standard is "Secure/Multipurpose Internet Mail Extensions" (S/MIME). As its name implies, S/MIME is an extension of the MIME standard and provides secure transmission of e-mail messages in the MIME format. Security is achieved by using digital signatures and an encryption technique such as DES as explained above. Other secure e-mail standards include "Privacy Enhanced Mail" (PEM), "Pretty Good Privacy" (PGP) and "MIME Object Security Service"

Secure Web based security schemes SHTTP/SXML are also implemented in the present invention.

OBJECTS AND SUMMARY OF INVENTION

Accordingly it is an object of the present invention to provide a method and apparatus that overcomes these limitations of the prior art.

It is another object of the present invention to provide a method and apparatus for transmitting/receiving class 1, 2, and 3 fax images, optically scanned images and screen captures, over global area packet switched networks.

It is another object of the present invention to provide a method and apparatus for transmitting/receiving standard class 1, 2, and 3 fax images, optically scanned images and screen captures over the Internet.

It is another object of the present invention to provide a method and apparatus for transmitting/receiving class 1, 2, and 3 fax images, optically scanned images and screen captures in a highly secure and private manner.

It is another object of the present invention to provide a method and apparatus for transmitting/receiving class 1, 2, and 3 fax images, optically scanned images and screen captures from a verifiable known spatial location.

It is another object of the present invention to provide a method and apparatus for transmitting/receiving class 1, 2, and 3 fax images, optically scanned images and screen captures from a biometrically verifiable person

It is a further object of the present invention to provide an economical device that can be easily connected to present class 1, 2, and 3 fax machines, optical scanners and screen capture methods

and that will enable them to communicate over internet global area packet switched networks.

It is a further object of the present invention to provide an economical device that can be easily connected to present class 1, 2, and 3 fax machines, optical scanners and screen capture methods that provides a built in electronic mail agent and means for 2 dimensionally compressing and selectively transforming the image data stream into at least the following Protocols; IPv4 and IPv6, e-mail protocols SMTP/POP3/MIME, World Wide Web Protocols HTTP/HTML/XML, File Format protocols TIFF/TIFF-FX/JPEG/JPEG2000/MPG and Tcp and UDP formats and PKI security encryption protocols Rijndael/DES/S-MIME/PGP/RSA/SET and web based security protocols S-HTTP/SXML/
for transmission/reception over the internet global area packet switched networks.

It is a further object of the present invention to provide a device that can easily be connected to class 1, 2, and 3 fax machines that allows standard non-facsimile e-mail to be printed out thereon.

It is a further object of the present invention to provide a device that can easily be connected to class 1, 2, and 3 fax machines that allows standard non-facsimile web pages to be printed out thereon.

It is a still further object of the present invention to provide a device that can be easily connected to standard class 1, 2, and 3 fax machines, optical scanners and screen capture methods to convert the image data stream to MIME enabled e-mail format for transmission/reception with similarly equipped fax machines and e-mail capable computer terminals over the Internet. It is a still further object of the present invention to provide a device that can be easily connected to standard class 1, 2, and 3 fax machines, optical scanners and screen capture methods to convert the image data stream to TCP and UDP enabled format for direct IP address transmission/reception with similarly equipped fax machines, printers, image rendering machines and capable computer terminals over the Internet.

It is a still further object of the present invention to provide a device that can be easily connected to standard class 1, 2, and 3 fax machines, optical scanners and screen capture methods to convert the image data stream to HTTP enabled Web Based format for transmission/reception with similarly equipped fax machines, printers, image rendering machines and Web capable computer terminals over the Internet.

It is a still further object of the present invention to provide a device that can be easily connected to standard class 1, 2, and 3 fax machines, optical scanners and screen capture methods to convert the image data stream to XML enabled Web Based

format for transmission/reception with similarly equipped fax machines with similarly equipped fax machines, printers, image rendering machines and Web capable computer terminals over the Internet.

It is another object of the present invention to provide a method and apparatus for uniquely identifying the geo centric location of the sending and receiving apparatus

It is another object of the present invention to provide a method and apparatus for uniquely identifying the biometrics of the sending and receiving parties.

It is another object of the present invention to provide a method and apparatus for transforming electronic data from one transmission specification to another for sending over a computer network.

It is a further object of the present invention to provide a method and apparatus for transforming electronic data from one transmission specification to another for sending over a computer network, wherein the transformation is accomplished in a network router.

It is a further object of the present invention to provide a method and apparatus for transforming electronic data from one transmission specification to another for sending over a computer network, wherein the transformation is accomplished in a network server.

It is another object of the present invention to provide a method and apparatus for transforming electronic data from one transmission specification to another for sending over a computer network, wherein the transformation is accomplished in a network device.

It is a still further object of the present invention to provide a method and apparatus for implementing the present invention over land line as well as wireless network architectures.

These and other and further objects of the present invention are accomplished in one embodiment of the present invention by a device having signal recognition means, a data store and forward buffer, protocol conversion means, an electronic mail agent, management and output means, compression/decompression means, encryption/decryption means, and software for accomplishing the desired transmission of fax images, optically scanned images and screen captures over internet global area packet switched networks.

These and other and further objects of the present invention are accomplished in another embodiment of the present invention by a device having signal recognition means, a data store and forward buffer, protocol conversion means to TCP and UDP ,a Direct IP addressing means, management and output means, compression/decompression means, encryption/decryption means, and

software for accomplishing the desired transmission of fax images, optically scanned images and screen captures over internet global area packet switched networks.

These and other and further objects of the present invention are also accomplished in another embodiment of the present invention by a device having signal recognition means, a data store and forward buffer, protocol conversion means, an Web Based user agent, management and output means, compression/decompression means, encryption/decryption means, and software for accomplishing the desired transmission of fax images, optically scanned images and screen captures over internet global area packet switched networks.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a flow chart illustrating the operation of various embodiments of the present invention;

Figure 2 is a pictorial view of a system according to the present invention;

Figure 3 is a functional block diagram of the system of Figure 1;

Figure 4 is a detailed block diagram of the "user ecom" block of Figure 2;

Figures 5-8 are flow diagrams of the various operational modes of the present invention;

Figure 9 is a detailed block diagram of an embodiment of the present invention showing the functional components thereof; and

Figure 10 is a view of a keypad for controlling and operating the present invention;

Figure 11 is a block diagram of a the transmitter/receiver sections of a conventional facsimile machine;

Figure 12 is a further block diagram of the system of the present invention;

Figures 13 - 16 are block diagrams of various implementations of electronic document transmission over of computer network in accordance with the present invention;

Figures 17 - 28 illustrate various embodiments of devices for the sending of documents over a computer network;

Figures 29 - 30 illustrate keyboard arrangements which may be used in apparatus which implement the present invention;

Figure 31 - 34 are further pictorial views of various embodiments of the present invention; and

Figures 35 - 47 illustrate the present invention in a gateway.

DESCRIPTION OF INVENTION

Referring now to Fig. 1 there is shown a system 10 for transmitting/receiving a fax over the internet global area networks 12. A local fax machine 14 is connected by line 15 to a signal manipulation device 16 which is in turn connected to a

plain old telephone (POTS) line 18 which is terminated in an electronic mail agent server 20 such as a commercial or public server which in turn is connected to or resident on the internet global area network 12. A remote electronic mail agent server 22 resident on the internet global area networks 12 at a remote location is connected over a POTS line 24 to another device 16 which in turn is connected to a remote fax machine 26 by another line 15. Fax machines 14 and 26 can be any class 1, 2, or 3 fax machines currently available on the market and are connected to the usual domestic power source at 28. Devices 16 have their own power supplies 30 which convert the usual AC power to the appropriate voltages to power the various components within the devices 16 as will be described in detail herein.

Figure 2 shows in block diagram form the system of Fig. 1 along with a privately accessible address book of public encryption keys 32 which may be accessed by direct dial up phone lines 34. In addition to the remote device 16 and fax machine 26 the remote agent server 22 may be connected by POTS line 36 to a modem 38 and computer 40 which can store and display the data stream available in the agent server 22.

Referring now to Fig. 3 the signal manipulation device 16 is shown in detailed block diagram form. As will be described herein device 16 takes the fax image data stream, removes the 1 dimensional compression scheme, compresses the now native

facsimile image data with any number of 2 dimensional table compression schemes, for example Lempel-Ziv-Welch or other multi dimensional compression schemes such as harmonic matrix multiplication and wavelet transforms for Besov spaces and converts it into an e-mail or retains the T30 data stream and encapsulates in TCP and UDP compatible format for transmission over the internet global area network 12. Device 16 will henceforth be called 'ecom' 16. This, along with the necessary management of the entire procedure, is accomplished in one embodiment by the device of Fig. 3.

When fax machine 14 initiates a call the ecom 16 responds as if it were the remote fax machine called by fax 14. The usual handshake and identification information is exchanged by recognition box 42 and when confirmed passed to the store and forward buffer 44. From here the data stream will be sent to the various other function within ecom 16 in accordance with the instructions in box 42. Data compression/decompression is usually accomplished while the data is in buffer 44 also. Next the native facsimile data stream is converted into electronic mail (e-mail) format in box 46 and phone number to e-mail address header conversion are accomplished. Image compression including JPEG, GIF, and LZW TIFF-F and TIFF-FX; audio and video compression such as MPEG; and e-mail extender such as MIME/S-MIME are also accomplished, at this time. If encryption is indicated

the converted data stream is directed to encryption/decryption block 48 for coding as will be described later. If coding is not indicated the data stream is passed to electronic mail agent 50 which performs store/send user/password identification functions as necessary to interface with the selected server 20. Electronic mail agent 50 preferably is a commercial mail agent but it may be any public or private mail agent. In one embodiment both commercial and public electronic mail agents are provided.

As may be seen in Figs. 8 and 9, a keypad 52 is provided to input special instructions, address information and status information such as "e-mail waiting" and the like. From box 52 the converted and formatted data stream is passed to box 54 for final mail agent server phone number, send/receive and connect signal functions. The data stream is then ready to be sent dynamically to the selected local agent server 20 resident on the internet global area packet switched networks 12 over a POTS line 18.

From this point on the data stream is under the control of the usual global networks servers, managers, and providers until it reaches its destination at the remote ecom 16 connected to the addressed remote fax machine 26. The flow diagram shown in Fig. 4 illustrates this sequence of operations.

While I have shown the ecom 16 connected to the server 20 by a telephone line, to include DSL, any transport mechanism can be used to transmit the data stream to/from the internet global area networks server 20 such as cellular, satellite, microwave, cable,broadcast and photonic.

In the event encryption is indicated the converted data stream is routed through box 48 from box 46 and then to electronic mail agent 50. The flow diagram in Fig. 5 illustrates this sequence.

Referring now to Figs. 2 & 6 there is shown another embodiment of the present invention where the local fax machine 14 can transmit an image to a remote computer. In this configuration since the converted data stream received at server 22 is in e-mail format it can be sent directly to a computer 40 which with the proper modem can store, display and print out the transmitted document.

Figure 7 is a flow diagram of a still further embodiment of the present invention in which it is only desired to encrypt a conventional fax transmission. In this configuration the ecom 16 processes, and encrypts the data stream but then bypasses the mail agent and sends the signal directly to the POTS line which is also connected to the remote ecom 16 and fax machine 26 via standard telephone number addressing. The data stream is

received by the remote ecom which automatically decrypts it and prints it out on the remote fax machine.

Figure 8 is a schematic block diagram of the ecom 16 showing the general layout and interconnection of the various components making up the ecom 16. Lines 15 from the physical stand alone fax machines 14 and 26 are connected to the bus 60 in ecom 16. Bus 60 connects all of the components together and to the output POTS lines 18 or 24. Modems 62 and 84 serve as input and output modems during transmission and the reverse for reception of data. CPU 72 contains the instruction sets needed to run the ecom and may be any CISC or RISC micro processor. ASIC chip 64 along with programable flash EPROM 68 contain the software instruction sets for the CPU and the TCP/IP, SMTP, MTA, POP, UDP and HUDP protocols and the algorithms for attaching the class 1, 2, and 3 fax data stream (Phase C data) to MIME enabled commercial and/or public electronic mail format. EPROM 70 is a mail user agent that contains the commercial and/or public mail boxes and EPROM 66 is a flash EPROM containing the encryption/decryption algorithms. RAMS 74, 76, and 78 provide for storing and forwarding data to the ASIC and CPU chips and to the facsimile and e-mail data streams. D/A block 88 is an analog to digital converter which encapsulates the fax image data stream into MIME e-mail digital format and vice versa. Block 80 provides compression/decompression operations on the data streams. USART

block 90 is a universal asynchronous transmitter/receiver chip for transferring the keypad 52 entered commands to the foregoing components and to the displays 94 and 96. which indicate system status. A voice processor chip 92 and speaker 98 and auxiliary port 102 may also be provided. The fax machine and POTS lines are connected through standard RJ11 connectors. The power supply 30, which may be housed within ecom 16 if desired as shown in Fig. 8, takes standard AC power and converts it to the necessary line tone/ring generator, DC and other voltages necessary for running the ecom 16. An on/off switch 100 turns the ecom on and off.

Referring now to Fig. 9 the keypad 52 has the usual QWERTY keyboard and the usual numerals 1 through 0. In addition there are provided special function keys that combine several key stroke commands of the usual computer into single stroke keys for the particular functions. Thus the @ key, the Dot key, for addressing e-mail; COM for commercial, NET for network, EDU for education, ORG for other organizations, MIL for military, and GOV for government, provide quick accurate domain addressing; SEND MAIL, GET MAIL, PREVIEW MAIL, DELETE MAIL, PRINT, for the obvious operations and PRIVATE for coding transmissions are also provided.

To send a fax from a local to a remote fax machine over the internet global area networks according to the present invention the following dynamic sequence takes place:

The facsimile goes "off hook" raising the voltage on the line that is connected to the system. The system detects the raised voltage on the line and custom software stored within RAM 202 and/or ROM 203 instructs the system to generate a line tone consistent with specific country telephony voltage requirements and simulates a "live" connection to a telephone central office telco switch.

Upon receipt of the facsimile transmission the remote system stores all of the facsimiles in RAM 202. Each page of the facsimile is "de huffmanized" to remove all "inferior" data compression. Each line of each page of the facsimile is then un-encoded from its Run Length Encoding (RLE) or Modified Relative Address Designate (READ), resulting in uncompressed binary machine code (logic "1s" and "0s") that represent each bit (including white spaces) of the entire original native facsimile image data that was scanned by the facsimile machine The uncompressed binary code is then compressed using 2 dimensional or other advanced compression algorithms that are stored in ROM 203. If the facsimile message is to be encrypted, the compressed binary is encrypted. The encryption algorithm can be any public or secret key encryption algorithm that is stored in ROM 203 and

includes, for example, S-MIME, S-HTTP, SXML, SET, Rijndael, PGP, DES Vernam ciphers and RSA. Additionally the multi dimensional codecs of the harmonic matrix multiplication compression schemes available in this invention can be adapted to perform non-recoverable-disappearing key encryption. The transformed original facsimile is stored in RAM 202 and is inserted and identified, via the e-mail header, as a MIME compliant message and is sent to the e-mail recipient identified in the to: field of the MUA header.

The user inputs or retrieves the IP e-mail address, that is associated with the intended recipients phone number of the selected remote fax machine via the keypad 52 or remotely from the flash eprom or remote data base. The LCD 94 displays, via the USART 90 this information. The apparatus defaults or the user then depresses the SEND MAIL key. If native fax data is present in the memory buffer the CPU instruction set begins conversion of the data together with the ASIC 64 into packet formats. If no native fax data is present in memory then the LCD94 displays a "waiting for fax" default message. The native fax image data data is compressed via box 80 and the CPU checks to see if encryption is indicated. If encryption is required the CPU instructs the ASIC 64 with EPROM 70 to perform the encryption and stores the result in memory. The mail user agent and MIME type generator is then invoked by the CPU from instructions

stored in eprom<s>. The LCD 94 then indicates "mail is ready for delivery". The user then depresses the send mail key or the device by default executes the send mail commands. The device connects to a packet switched network via the modem and sends the converted facsimile as e-mail that was stored in the memory buffer and maintains the buffer for a specified time length. Upon receipt of proper server Message Delivery Notification return codes that the message has been received the CPU instructs the modem 84 to close and the ecom is returned to ready for further traffic. If additional receipt notification codes have been requested the ecom device remains open until the recipient codes are returned or a specified default time has elapsed. If either MDN or specified return codes are not recived in a timely manner the ecom device will report that the transmission shoud be considered failed.

At the receiving end after transmitting the internet global area packet switched networks the data manipulation sequence in the remote ecom is essentially the reverse of that just described. In addition a user of the ecom can query its mail server to see if there is fax e-mail waiting that could not be delivered previously. Also standard or encrypted e-mail other than converted fax image data can be printed out on a fax machine attached to an ecom device. The user presses GET MAIL which displays the command on LCD 94 and then the CPU instructs the

appropriate EPROM to retrieve the appropriate server location and to contact same via the modem 86. Upon proper user identification by the server if there is mail the server will send it to the MUA EPROM 70 and the CPU will then send it to memory buffer and terminate connection to the server. The usual "preview mail" capability can also be included in ecom 16 if desired. The ecom device is also capable of being a "direct delivery" mail box such that a ecom converted message can be sent directly to the device. One such example is where the e-mail address of the recipient is a special ecom mail address that includes both the recipients phone number and unique ecom device email user identity ie.5085404511devicepenelope@ecom.net

In order to provide structure and compatibility to the format of e-mails sent across the Internet, the Simple Mail Transfer Protocol (SMTP) was developed and adopted in August of 1982. A full description of the SMTP standard can found in RFC-821 and RFC-822 available at many sites on the Internet.

In summary, the SMTP standard breaks an e-mail message into two parts, a "header" and a "body". The header contains fields of control information which e-mail software can examine and use to accomplish their tasks in routing the e-mail. The body contains the text of the message for the end recipient. In accordance with the SMTP standard, all data transferred must be 7-bit US-ASCII

and be divided into lines of 1000 characters or less. The message may also not exceed a certain length.

If e-mail software written for the SMTP standard encounters a field which it does not understand, the field is ignored. This attribute allows the SMTP standard to be extended by adding additional fields in order to provide more e-mail capabilities.

While the SMTP standard was considered state-of-the-art at the time of its adoption in 1982, the wide spread use of e-mail over the Internet as a communication mechanism for various types of information lead to the need for a more robust and comprehensive standard. Thus, the SMTP standard was extended by the adoption of the Multipurpose Internet Mail Extensions (MIME) adopted in June of 1992. MIME extends the SMTP by adding additional fields for mail message headers that describe new types of content and organization for messages. The MIME standard is fully describe in RFC-1521, which also is available at many sites on the Internet.

In summary, the MIME standard allows a message to contain:

Multiple objects in a single message;

Text of unlimited line and overall length;

Character sets other than US-ASCII;

Multi-font messages;

Binary or application specific fields; and

Images, audio, video and multi-media messages.

In order to accomplish the above message content, the MIME standard defines the following new header fields:

1. MIME-Version header field - This field uses a version number to declare that a message conforms to the MIME standard;
2. Content-Type header field - This field is used to specify the type and subtype of the data in the body of the message and defines any encoding of the data. The content type can be:
    a. text - textual information;
    b. multi part - several body parts are combined into a single message;
    c. application - application data or binary data;
    d. message - encapsulating a mail message;
    e. image - still image data;
    f. audio - audio or voice data; and
    g. video - video or moving image data.
3. Content-Transfer-Encoding header field - This field is used to specify how the data is encoded to allow it to pass through mail transports having data or character set limitations;
4. Content-ID header field - This field is used to further identify the data in the message body; and
5. Content-Description header field - This field is used to further describe the data in the message body.

Thus, a plain text, ASCII e-mail message in accordance with the MIME standard would might have the following header field entries:

MIME-Version: MIME:Version 1.0

Content-Type: text/plain; charset="us-ascii"

Content-Transfer-Encoding: 7bit

Content-ID: blank

Content-Description: blank

In addition to these standard MIME headers MIME X header fields may be used to extend this inventions capabilities. The method and apparatus for sending and receiving facsimile transmissions via e-mail over the Internet will now be further explained with reference to Figure 11.

Figure 11 is a block diagram illustrating the basic construction of the computer system which controls the operation of Applicant's invention. As Figure 11 shows, the system includes a number of interrelated elements all operationally connected by a buss 201. The system includes RAM memory 202 and ROM memory 203 where instructions and temporary data storage areas of a computer program reside ane where in rom the ecom device unique identity may be stored in firmware. The system also includes a display 204 and a keyboard 205 so that the various functions of the system and be initiated and observed. Display 205 can be formed of a number of different devices including a liquid crystal

display, a cathode ray tube display and an LED display. In addition, a number of different configurations for keyboard 205 can be used. Figure 12 illustrates one embodiment of a keyboard configuration in accordance with the present invention.

The system further includes mass storage device 216 which allow the system to store data to and receive programming instructions from such devices as magnetic floppy disks and tape units.

A PCMCIA "Personal Computer Memory Card International Association" card slot 206 also is provided. Slot 206 defines a 68-pin interface in accordance with current JEIDA PCMCIA standards with respect to physical and electrical specifications. Thus, Type I, Type II and Type III PCMCIA cards can be used with the present invention. Such cards include flash memory, RAM, and ROM, modem devices, LAN adapters, cellular telephone communication devices and mass storage devices such as miniature hard disk drives.

A smart card slot 207 also is provided. The ability to use smart cards allows the system to be automatically configured in a particular way for a particular installation.

Also connected to buss 201 are various input/output (I/O) peripherals 208 which allow the system to communicate with the user and with the outside world through such devices as printer 209, microphone 210, serial port 211, parallel port 212, speaker

213, modem 214 and auxiliary port 215. Printer 209 may be selected from a number of conventional printers known in the prior art. In addition, serial and parallel ports 211 and 212 conform to conventional port standards, also known in the art.

Microphone 210 can be used to provide verbal commands to the system as well as permit the system to be used in a "telephone" mode in conjunction with speaker 213 and voice processor <?>. Modem 214 serves as the interface between the system and the telephone line.

Auxiliary port 215 permits other equipment to be easily connected to the I/O port interface. Such equipment includes additional printers, modems, a video camera and image scanners and the like.

The heart of the system is central processing unit (CPU) 200 which supervises the flow of information between the various elements of the system and which perform logic calculations and other functions based on instructions in the computer program stored in RAM 202, ROM 203, a PCMCIA card inserted in PCMCIA slot 206 or a smart card inserted in smart card slot 207 and data associated with the program.

The system also includes a number of other features such as RJ11 and RJ45 connectors and cellular, cable and satellyte communication cababilities.

As the system illustrated in Figure 11 provides all of the capability of a computer system, it can be easily programmed as such to provide multimedia recording through microphone 210 and a video camera connected to auxiliary port 215 and play back on display 204 and speaker 213. The system may also be used in a video conferencing mode. In so doing, the system has the ability to use any one of a number of compression/decompression algorithms (codecs). A codec is a system for removing or restructuring data to decrease the size of a file. Codecs includes

Cinepak

Intel Indeo Video R3.2

Intel Indeo Video Raw

Microsoft Video 1

Microsoft RLE

QuickTime

In accordance with the present invention, a standard class 1, 2, or 3 facsimile machine is directly connected to the system via one of the above described RJ11 telephone connectors. The user places a document in the facsimile machine and dials a key code number. The key code number identifies to the system which telecommunications form the transmission of the document will take, i.e., direct dial to a remote system of the invention, direct dial to a remote facsimile machine or transformation to

MIME compliant e-mail and can be expanded to include IPv6 addressing, thus enabling "old" facsimile machines to become IP directly addressable. In the direct IP embodiemant of the invention a "virtual telephony circuit" is established between the devices and the modulated tones generated by the originating fax machine are first stored in a memory buffer a session based TCP connection is established between the 2 devices and T30 facsimile data types are encapsulated to identify which modualtions were used to generate the data and contain the phase C data that was obtained by the ecom device in its inventive operation. Once the "virtual circuit has been established and capabilities exchanged the "buffered" data is sent to the recieveing ecom device which "directly passes" facsimile image data to the connected facsimile machine. One skilled in the art will readily appreciate that the cpu, memory and asic capabilities of the invention can be embeded in a facsimile machine removeing the need for a separate ecom device.

While there are given above certain specific examples of this invention and its application in practical use, it should be understood that they are not intended to be exhaustive or to be limiting of the invention. On the contrary, these illustrations and explanations herein are given in order to acquaint others skilled in the art with this invention and the principles thereof

and a suitable manner of its application in practical use, so that others skilled in the art may be enabled to modify the invention and to adapt and apply it in numerous forms each as may be best suited to the requirement of a particular use.